POSTERIORISM[1] AND OLD-BABYLONIAN MUSICOLOGY

By: Richard Dumbrill

Abstract

In this article, I will demonstrate how posterioristic musicology, or inductive theory arising from conclusions drawn from prior premises has led, I contend, to a misconception of Old-Babylonian musicology.

Texts which are chronologically distant from one another by over one thousand years have been commingled to shape a universalist theory. Posteriorism would be legitimate in the absence of an autonomous anterior theory but would be illegitimate should it serve the assimilation of a posterior theory into anterior evidence in order to legitimise misconceptions.

Introduction

Text U.7/80 (*UET* VII, 74) is an Old-Babylonian manuscript from around 1800 BC. This date was competently ascribed by the eminent Professor Oliver Gurney from the University of Oxford[2].

The Old-Babylonian period refers to the First Babylonian dynasty which extended from the 20th to the 16th centuries BC. Old-Babylonian also refers to the historical status of the Akkadian language during that period.

Text *CBS* 10996 is a Neo-Babylonian document which dates from around 600 BC[3]. This manuscript was initially said to belong to the Kassite period (1600-1100 BC) but this was later emended. The Neo-Babylonian period, or Empire was also known as the Second Babylonian or Chaldean Empire. Neo-Babylonian also refers to the historical status of the Akkadian language at that period.

Neither are there known texts similar in content to U.7/80 dating from the Neo-Babylonian Period, and nor are there known texts similar in content to *CBS* 10996 dating from the Old Babylonian Period.

Therefore texts U.7/80 and CBS 10996 are chronologically, philologically and systemically distant from each other by about 1200 years.

---

1. Galileo Galilei, *Treatise on demonstration*, D2.7.
2. Gurney, O.R., An Old Babylonian Treatise on the Tuning of the Harp, *IRAQ* XXX, (1968), pp. 229-233.
3. Kilmer, A., Two New Lists for Mathematical Operations, *Orientalia* 29, (1960), pp. 273-308 and Tab. LXXXIII.

Additionally, U.7/80 is prescriptive as it gives precise and detailed instruction for the construction of a system, while *CBS* 10996 is descriptive in that it says precisely that the subject is a series of fourteen intervals rather than developing theories about it. They each serve very different purposes at very different times.

However, this does not exclude the hypothetical reconstruction of past theories with prior premises as long as the methodological process is rigorously justified, step by step. As an example, the whole corpus of Ancient Greek music has been rebuilt from Mediæval and later copies of now inexistent texts used for the restoration of meagre traces of theory of music written on scraps of papyri, themselves copies of originals, now inexistent, which would have been written at least six centuries earlier, and therefore, however detailed, the credible reconstruction must remain conjectural.

U.7/80 = *UET* VII, 74 (Circa 1800 BC)

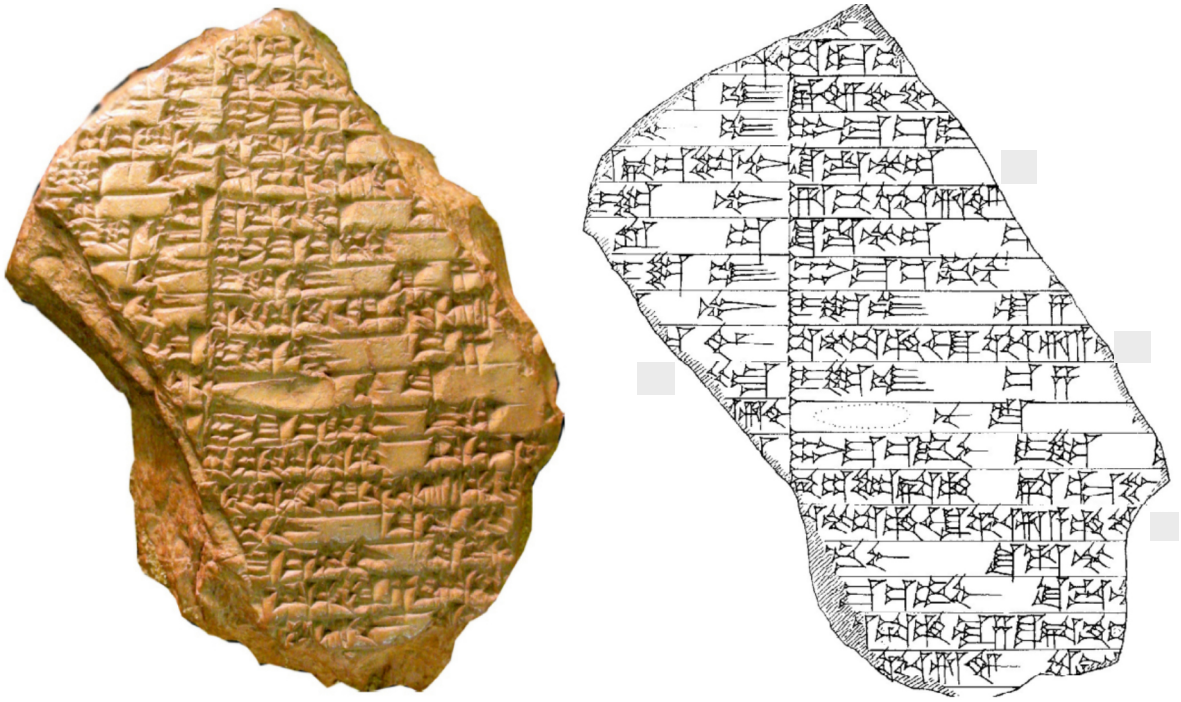


Figure 1. Cast of U.7/80 (= *UET* VII, 74). Photograph by the author. Courtesy of the Trustees of the British Museum. Hand copy from Professor Gurney. Height 100 mm. Width 89 mm. The tablet was returned to the IRAQ Museum, Baghdad, in the 1970s but I was unable to locate it during my many visits.

U.7/80 = *UET* VII, 74. Transliteration and translation

i [*šum-ma* ^{giš}**ZÀ.MÍ** *pi-i-tum-ma*]	i if the *sammû* is *pītu*
ii [*e-e*]*m-b*[*u-bu-um la za-ku*]	ii *embūbu* unclear
iii *ša-al-š*[*a-am qa-at-na-am tu-na-sàḫ-ma*]	iii tense third thin
iv *e-em bu-bu-u*[*m iz-za-ku*]	iv *embūbu* is clear
v *šum-ma* ^{giš}**ZÀ.MÍ** *e-em-bu-bu-um-ma*]	v if the *sammû* is *embūbu*
vi *ki-it-mu-um* [*la za-ku*]	vi *kitmu* unclear
vii *re-bi úḫ-ri-im* [*tu-na-sàḫ-ma*]	vii tense fourth rear
viii *ki-it-mu-um i*[*z-za-ku*]	viii *kitmu* is clear
ix *šum-ma* ^{giš}**ZÀ.MÍ** *k*[*i-it-mu-um-ma*]	ix if the *sammû* is *kitmu*
x i-šar-tum la za-[*ka-at*]	x *išartu* unclear
xi *ša-mu-ša-am ù úḫ-ri-a-a*[*m tu-na-sàḫ-ma*]	xi tense *šamuššu* and rear
xii *i-šar-tum iz-za-*[*ku*]	xii *išartu* is clear
xiii *nu-su*[*ḫu-um*]	xiii tightening
xiv *šum-ma* ^{giš}**ZÀ.MÍ** *i-šar-t*[*um-ma*]	xiv if the *sammû* is *išartu*
xv *qa-ab-li-ta-am ta-al-pu-*[*ut*]	xv *qablītu* unclear
xvi *ša-mu-ša-am úḫ-ri-a-am te-*[*ni-e-ma*]	xvi relax *šamuššu* and rear
xvii [^{giš}]**ZÀ.MÍ** *ki-it-mu-*[*um*]	xvii *sammû* is *kitmu*
xviii [*šum*]*-ma* ^{giš}**ZÀ.MÍ** *ki-it-m*[*u-um-ma*]	xviii if the *sammû* is *kitmu*
xix [*i-ša*]*r-ta-am la za-ku-ta-am t*[*a-al-pu-ut*]	xix *išartu* unclear
xx [*re-bi*] *úḫ-ri-im te-ni-e!*[*-ma*]	xx relax fourth rear
xxi [^{giš}**ZÀ.MÍ** *e-em-bu-bu-um*]	xxi *sammû* is *embūbu*

I have renumbered the lines of the text to avoid confusions with other editions. The columns above are the transliteration and the tentative translation of the fragmentary text U.7/80. I will now show how its contents could have been understood without contamination from more recent texts.

1) Line i has a straight forward formulation: i if the *sammû* is *pītu*. This locution is protastic and calls for its apodosis which appears in line iv: 2) Line ii indicates the status of something: ii *embūbu* unclear. Here the unknown thing is *embūbu* and it is qualified as unclear. 3) Line iii gives an instruction to tense two elements: iii tense third thin 4) Line iv is the apodosis of the first line: iv [then] *embūbu* is clear.

First, philology

At the first line, the word *sammû* which I initially and incorrectly thought that it meant 'harp' on the basis that during the Old Babylonian Period, harps are more frequent than lyres in the iconography, is correctly defined as a lyre in the *Chicago Assyrian Dictionary* for the following reasons: Description: [x] **giš.zà.mí kù.babbar gar.ra** x *sammû*(-s) inlaid with silver[4]; 6 **zà.mí** (of gold)[5]; 2 **giš.zà.mí kuš.máš.gi$_6$.bi 2 se.gín.bi 5 gín ba.a.si** two lyres, two black goatskins (and) five shekels of paint were used for them[6]; ⌜*qul*⌝*-lat* **KÙ.GI** *ša* **GIŠ** *ša-am-me-e ša* **LÚ.NAR** gold loops for the singer's lyre[7]; **6 ZÀ.MÍ.MEŠ KÙ.GI** *ina pani* **LÚ.NAR.ME** six gold lyres, available to the musicians (mentioned among utensils) in the *bīt urinnu* 'literally the "house of the standard"'[8]. cf. **4 GIŠ.ZÀ.MÍ KÙ.GI**[9], **4 GIŠ.ZÀ.<MÍ>.ME** *mandītu ḫurāṣi ana batqa* four *sammû*(-s) with gold mountings (given) for repair[10] cf. **4 GIŠ.ZÀ.[MÍ]** ; x gold *batqa ša* **GIŠ.ZÀ.MÍ** for the repair of a lyre[11]; see also *parašitu* "of the Marhaši type," *urītu* "of the Ur type".

4. Publications of the Babylonian Section, University of Pennsylvania, 8/2 194 i 20.
5. HE 145, cited Scheil, *Revue d'Assyriologie*, 23 39.
6. *Babylonian Inscriptions in the Collection of J.B. Nies*, 9 352:1, also 353:1, (all Old-Babylonian)
7. R.P. Dougherty, *Goucher College Cuneiform Inscriptions*, 2 24:1 (Neo-Babylonian).
8. *Yale Oriental Series, Babylonian Texts*, 6 62:27.
9. Ibid., 7 185:24
10. Ibid., 6 192:20; ibid. 189:23
11. Ibid., 6 53:11 (all Neo-Babylonian).

Are the above descriptions sufficient to prove that the *sammû* was a lyre? it is certain that in most cases the literature describes a richly adorned instru-ment: 'inlaid with silver'; 'gold'; 'gold loops for the singer's *sammû*'; 'six gold lyres, available to the musicians in the *bīt urinnu*; '*sammû*(s) with gold mountings'; 'gold' for the repair of the *sammû*. Furthermore, the *sammû* is hosted in the *bīt urinnu* or the 'house of standards' which was the temple treasury. Therefore it is a precious instrument. Now during the Old Babylonian Period, large ornate lyres had all but vanished perhaps with the exception of Mari where they are possibly mentioned during the last Amorite dynasties of *Yašma-Addu* and *Zimrī-Līm*, (1787-1762 BC). There, a particular type was known as *paraḫšitum*, perhaps because the instrument came from *Marḫuš* in Luristan on the basis that during the third and second millennia in the country of *Marḫuš* there had been a shift of the 'm' to the 'p' hence the adjective *marḫašitum* which became *parḫašitum*[12].

It is therefore interesting to note that the *sammû* if indeed it is a richly adorned lyre, would be more related to the Sumerian third millennium BC, similar to the lyres excavated by Woolley ar Ur in the late nineteen-twenties[13], than from the second millennium during the Old-Babylonian period. We could conclude that text U.7/80 might be the copy of a much older theory, or the adaptation of Old-Babylonian theory to a legendary fourth millennium *sammû*.

There is another argument in favour of the *sammû* being the monumental boviform lyre which I believe was the instrument named at line i of U.7/80.

In a forthcoming article about philological remarks to some essential texts, my colleague and friend Theo J.H.Krispijn writes that 'the strings of the *sammû* instrument [should be] reconsidered' (**uktin** = *nabnītu* xxxii, lines 1 to 11). There, crucially, Krispijn says that while *nabnītu* xxxii is unequivocally a document written around 600 BC during the Neo-Babylonian Period, there are earlier Middle-Babylonian

12. Marcetteau, M., *Vie Musicale à Mari sous les dernières Dynasties Amorrites*, unpublished doctoral thesis, Université de la Sorbonne, (Paris, 2008), p. 311.
13. Woolley, L., Sir, *Ur Excavation.* Vols. I and II.

versions of this text dating from around 1000 BC, including a damaged version but most importantly, an Old-Babylonian precursor (UET VI, 358).

The *MSL* XVI[15] writes that '...regular sources for Nabnitu consist of large and typical lexical tablets [...] with Sumerian and Akkadian entries. So far there is just one piece of evidence from the Old-Babylonian Period ...'. The earliest regular sources appear toward the end of the second millennium BC, in both Middle-Assyrian and Middle-Babylonian copies. To date, twelve such Middle-Assyrian sources have been recovered, although most have not yet been published. All were excavated at Aššur, with the exception of one found at Kouyunjik and one unprovenanced. However, most sources are Neo-Assyrian as almost all of these come from King Ashurbanipal's library at Kouyunjik and exhibit the customary high scribal standard.

In the *History of the Cuneiform Lexical Tradition*, Niek Veldhuis writes that one the most important innovations of the Old-Babylonian Period is the sign list. They were widely used in scribal education. Exercise tablets with sign lists have been found by the hundreds and are known from almost all sites that yielded school tablets.

Nabnitu is a bilingual vocabulary which, like Antagal, Erimḫuš, and the so-called 'Group-Vocabularies', is to be considered Akkado-Sumerian as opposed to the older Sumero-Akkadian lexical series. Nabnitu stands apart from the other Akkado-Sumerian vocabularies, however, in that the two fundamental principles underlying its construction, the thematic order of the entries and the structuring of the sequences according to etymology, are not found elsewhere.

15. MSL, (*Materials for the Sumerian Lexicon*) the series **SIG$_7$.ALAN** = *Nabnītu*, edited by Irving, L. Finkel with the collaboration of Miguel Civil. *Pontificum Institutum Biblicum*. (Rome, 1982). The basic manuscript of **SIG$_7$.ALAN** = *Nabnītu* used until now (1982) in *CAD* was finished about thirty years ago [in 1982] by Benno Landsberger with the assistance of J.R. Kupper. The task of preparing the manuscript for publication was entrusted to Dr. Irving L. Finkel, former Research Assistant at the Oriental Institute [Chicago] (1976-1979), recently appointed Assistant Keeper of the Department of Western Asiatic Antiquities [Department of the Middle-East] of the British Museum.

Having set the philological and historical context of Nabnitu texts spanning two and probably three millennia, as I will argue, I will now include certain aspects of the musical terminology that Krispijn discusses in his forthcoming article.

Nabnitu lists the strings of an archetypal lyre, probably the monumental boviform type, I contend on account of the symmetrical arrangement of its strings as they appear in the mid-fourth millennium BC:

Figure 1. Monumental boviform lyre from a shell plaque. ca. 2600 BC

Figure 2. Portable lyre from the 'Ur Standard', ca. 2600BC

Although the two lyres above are roughly from the same period, le lyre to the left in figure 1 displays an older symmetrical disposition of the strings. The lyre in figure 2 shows that some time later, the strings have shifted towards the player. Now, the lyre in figure 1 shows eight strings. However, we cannot assume that the artist who depicted this amusing scene was competent in organology and I do not think we should take it that this instrument had eight strings, indubitably. What is more important is that the fan-like disposition means that the first and last strings were the longest and that the middle string was the shortest, should we assume that the instrument had nine strings, then we may guess that such a system would sound an ascending fifth followed by a descending fifth, sharing the same central pitch. But it could have been any other consecutive pitch series. This might sound like a far-fetched deduction. However, figure 3 next page shows such a symmetric instrument from Ancient Egypt and although much more recent by about a thousand years, it does not exclude my hypothesis that this

arrangement of the string layout existed with some Sumerian instruments in Early Dynastic times. Around 2600 BC when the strings plan shifted towards the player, it kept its symmetry but in a different manner: Earlier arrangement: g-a-b-c-d-c-b-a-g. More recent arrangement: g-a-b-c-d-e-f-g-a, where g-a = a-g; a-b = g-f; b-c = f-e and d-e = e-d. The intervallic arrangement in this modern disposition keeps the original symmetry since the intervals remain of the same value in both cases. This hypothesis remains, however, highly conjectural but as we shall see, it fits with the description in Nabnitu. Now Theo J.H. Krispijn has translated the Sumerian (see table 1 below) of lines 6, 7 and 8: **sa.x.a.ga.gul**, and string 9: [**sa.1**]**a.ga.gul.la** by: 'string x of the bigger back' and 'first string of the bigger back'. The four last string names are compound with **a.ga.gul.**(**la**) "(of) the bigger back" of the *sammû* instrument which designates the strings of the back of the instrument by opposition to the first string which would be placed closest to the head of the boviform lyre[16].

Figure 3. Block from a temple to the Aten at Karnak showing two blindfolded musicians. ca 1400BC.

16. For **a.ga**, see Krispijn 1990, 10-11. **gul** or **gu.la** is not a simple variant of **gal** "big", but an alternative form with the determination morpheme **-a**. Cf. **ur.^{d}nin.ĝir$_2$.su.gu.la** "Urninĝirsu the Elder" in addition to **ur.^{d}nin.ĝir$_2$.su** "Urninĝirsu (the Younger)" (Maeda 1988). Jagersma (2010, 268-269) regards the form as a derivation of the verb **gu.l** "to be big", but one could also think of an irregular comparative-superlative form of **gal** "big". The comparative of **tur** "small" even uses a different word base for the comparative **banda$_3$** "smaller, junior" . The function of morpheme **-a** after adjectives in Sumerian can generally be described as determination (Krecher, 1993). This determination sometimes indicates a comparative or superlative: **zi.d** "functional, true, favorable" e.g. **a$_2$.zi.da** "the more / most favorable arm, right arm" as opposed to **a$_2$.gub**(**u$_3$**) (<* **guba**?) "left arm".

17. Reconstructed ***sawuš** with /**w**/ as a glide. The /*w*/ is written with phonograms containing /*m*/ from the Old-Babylonian period onwards (Von Soden, 1995 GAG§21d).

Sumerian	Translation	Akkadian	Translation
1 **sa.sa$_2$ (=DI)**	'rival' string	*qud-mu-* ⌜*um*⌝	prime(?) (string)
2 **sa.ús$_2$** [17]	neighbouring string	*šá-mu-šu-um*	neighbouring (string)
3 **sa.3.sa.sig**	string 3 string thin	*šá-al-šu qa-a*[*t-nu*]	third (string) thin
4 **sa.4.tur**	string 4 small	<^{d}é>-*a.*[**dù**]	Ea-the creator
5 **sa.sa$_2$(=DI).5**!	fifth 'rival' string	*ḫa-am-*[*šu*]	prime(?) (fifth string)
6 **sa.4.a.ga.gul**	string 4 of bigger back	*ri-bi úḫ-ri-i*[*m*]	fourth of the rear (string)
7 **sa.3.a.ga.gul**	string 3 of bigger back	*šal-ši úḫ-ri-im*	third of the rear (string)
8 ⌜**sa.2.a.ga**⌝**.gul**	string 2 of bigger back	*ši-ni úḫ-ri-im*	second of the rear (string)
9 [**sa.1**] ⌜**a**⌝**.ga.gul.la**	1st string of bigger back	*úḫ-ru-um*	rear (string)
10 [**9**] ⌜**sa**⌝**.a**	9 strings	9 *pi-it-nu*	9 strings

Table 1. **SIG$_7$.ALAN** = *Nabnītu* xxxii (ca. 600 BC) = U.3011 = *UET* VII, 126.

Thus the strings four, three, two and one of the hypothetical instrument would be located at its 'bigger back' and as the only known instrument having a 'bigger back/bottom' would be the monumental boviform lyre or other lyres with other animals such as calves, and deer, it makes little doubt that the *sammû* was the monumental boviform lyre of the middle of the third millennium BC. This suggests that this instrument was a fundamental model during the next millennia up to the first[17]. The names of the strings as given in Nabnitu, or with forerunners of Nabnitu as early as the third millennium until the first, were not only the paradigm for the strings of the boviform lyre, but became a description of the fundamental enneachordal set[18].

Nabnitu

Nabnitu xxxii needs to be further explored for the understanding of U.7/80. Earlier, I said that this text is to be considered as an Akkado-Sumerian bilingual text as opposed to the older Sumero-Akkadian lexical series. However, Nabnitu xxxii stands apart from the other Akkado-Sumerian vocabularies for the following reasons: 1) The Akkadian is partly but not entirely a literal translation of the Sumerian. 2) The Sumerian entries are not prescriptive. They are descriptive in that they name and locate the nine strings of the lyre. 3) Sumerian lines 9 to 5 stand in symmetry with lines 5 to 1 while Akkadian lines indicate variations to the symmetry of the Sumerian.

17. Dumbrill, R., *The Birth of Music Theory*, ICONEA publication, (London 2020), pp. 39-43.
18. Ibid., pp. 44-51.

These variations in the Akkadian must be chronological variations of the system. 4) *qud-mu-um* in line 1 would be the adjective *qudmû*, meaning 'rival' rather than the noun. 5) Similarly, *ša-mu-šu-um* would stand for the adjective *šamušû*, 'neighbouring', understanding Sumerian **sa.uš** as **sa.ús**, the underlying Akkadian verb being *emēdu*. 6) Therefore *úḫ-ru-um* at line 9 would be the adjective *uhrû*, rather than the noun *uḫru*, 'rear' as found in lines 6 to 8.

Table 2, next page shows my hypothetical pitch extrapolation. I contend that from the central pitch 5=D, two fifths were projected on each side of the axis of symmetry: 5-1 (front) = D-A and 5-1 (back) = D-G. Then two fourths were projected from the same axis: 5-2 (front) = D-G and 5-2 (back) = D-A.

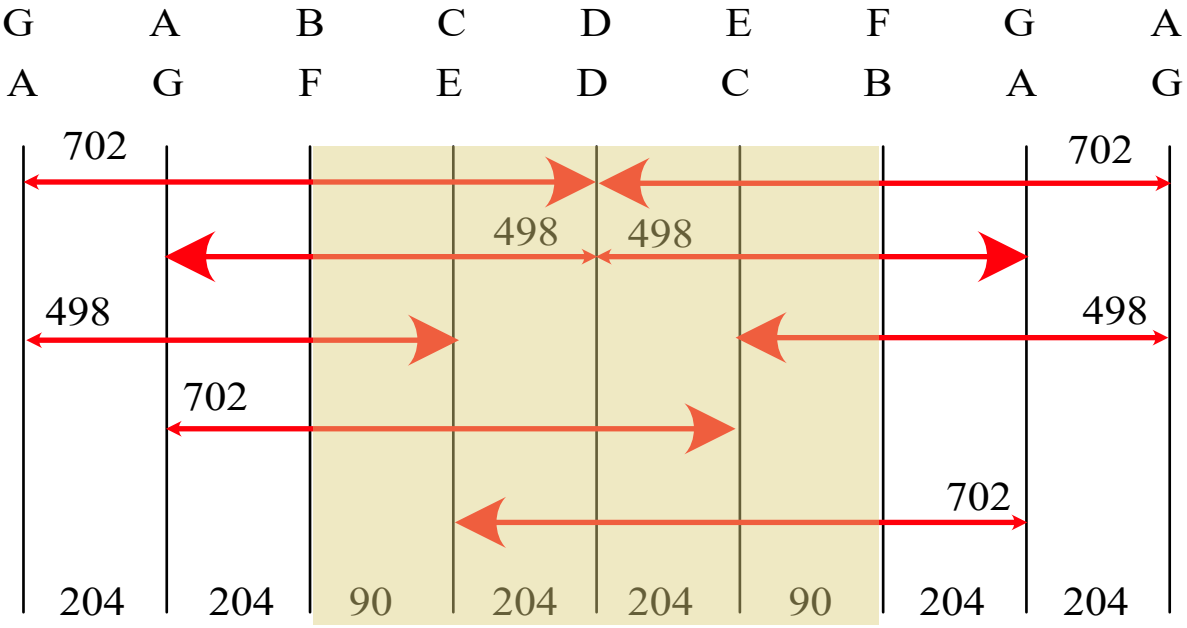


Table 2. extrapolation of the hypothetical Sumerian ditonic pitch set.

Then two fourths would be drawn from the extremities: 1-4 (front) = A-E and 1-4 (back) = G-C. Then two fourths from 3-4 (front) = F-C and from 3-4 (back) = B-E.

Therefore my hypothetical reconstruction of Nabnitu xxxii would generate an enneatonic descending pitch set of a-g-f-e-d-c-b-a-g where the interval between both strings 3 would be a dissonance of 588 cents which is not a 'regular' or 'Pythagorean tritone' of 612 cents'.

Reconstruction of text U.7/80 in its current status

Reconstruction of the first quatrain:

i if the *sammû* is *pītu*
ii *embūbu* unclear
iii tense third thin
iv *embūbu* is clear

At present we cannot yet say which set was *pītu.* We cannot say either what was the 'unclear' *embūbu* melodic interval. However if we are instructed to tense the 'third thin string', we know from Nabnitu xxxii that it is the 'third string of the front', an 'f'. The dynamic unclear interval *embūbu* must be f-b and the thetic unclear interval must also be f-b. Therefore the set of *pītu* must be a-g-f-e-d-c-b-a-g.

Thetic *embūbu* must be a-g-f#-e-d-c-b-a-g and dynamic d-c-b-a-g-f-e-d-c.

Reconstruction of the second quatrain:

v if the *sammû* is *embūbu*
vi *kitmu* unclear
vii tense fourth rear
viii *kitmu* is clear

Now we know that the set of *embūbu* is thetic a-g-f#-e-d-c-b-a-g = dynamic d-c-b-a-g-f-e-d-c. Therefore *kitmu* is the unclear dynamic fourth b-f or the thetic f#-c. We are instructed to tense the fourth string of the rear = c to c#. The 'clear' *kitmu* would be thetic fourth f#-c#. Therefore the thetic *kitmu* set must be a-g-f#-e-d-c#-b-a-g or dynamic g-f-e-d-c-b-a-g-f.

Reconstruction of the third quatrain:

ix if the *sammû* is *kitmu*
x *išartu* unclear
xi tense *šamuššu* and rear
xii *išartu* is clear

Now we know that the set of *kitmu* is thetic a-g-f#-e-d-c#-b-a-g or dynamic g-f-e-d-c-b-a-g-f. Therefore *išartu* is the unclear dynamic fifth f-b or the thetic fifth g-c#. We are instructed to tense strings two of the front and 1 of the rear. Therefore the clear thetic *išartu* must be

and clear thetic *išartu* must be g#-c#-g#. Therefore the thetic set of *išartu* must be a-g#-f#-e-d-c#-b-a-g# or dynamic c-b-a-g-f-e-d-c-b.

Line xiii suggests that in the quatrains above some strings had to be tensed.

Reconstruction of the next quatrain:

xiv if the *sammû* is *išartu*
xv *qablītu* unclear
xvi relax *šamuššu* and rear
xvii *sammû* is *kitmu*

We know that the set of *išartu* is thetic a-g#-f#-e-d-c#-b-a-g# which is dynamic c-b-a-g-f-e-d-c-b. we are told that *qablītu* is unclear. Dynamic *qablītu* is fifth f-b and thetic d-g#. We are instructed to relax strings two of the front and the rear string which gives thetic *kitmu* a-g-f#-e-d-c#-b-a-g which is dynamic g-f-e-d-c-b-a-g-f.

Reconstruction of the next quatrain:

xviii if the *sammû* is *kitmu*
xix *išartu* unclear
xx relax fourth rear
xxi *sammû* is *embūbu*

The set of *kitmu* is thetic a-g-f#-e-d-c#-b-a-g which is dynamic g-f-e-d-c-b-a-g-f. We are informed that *išartu* is unclear, dynamic f-b and thetic g-c#. We are instructed to relax the fourth string of the rear. Thus we have thetic a-c-f#-e-d-c-b-a-g or dynamic d-c-b-a-g-f-e-d-c

I have therefore conclusively proven that Old-Babylonian text U.7/80 could and should have been deciphered without the interference of more recent texts and that there is no evidence for this system being heptatonic other than it could have hosted heptatonism. I have demonstrated elsewhere[19] that had Old-Babylonians wanted a heptatonic version of the current U.7/80 text, they could have easily done so by modifying the instructions in U.7/80.

The text as it stands starts with the set of *pītum*. My explanation for this is that any system must start with a set the construction of which must be proven and this is precisely what Nabnitu xxxii does as I have

19. Dumbrill, R., *The Birth of Music Theory*, ICONEA Publications (London, 2019), p. 67.

demonstrated above. Furthermore, the symmetry in *pītu* is significant allegory with the symmetry of the paradigmatic lyre as well as systemically. Additionally, the term *pītu* means 'break, opening, opening ritual' which is appropriate, and that the unclear interval, *qablītu* which means 'middle part, inner part' (*CAD*, *sub q*, p.3) is precisely in the middle of the system described in Nabnitu xxxii.

Additionally, the nature of enneatonic sets is that they are what I would call 'poly-sets' in that each generates three 'pseudo modal' 'sub-sets'.

Another reason for U.7/80 being constructed as it stands is that *išartu* is the central set, or the axis of symmetry of the system as shown below:

pītu - embūbu - kitmu - ***išartu*** *- kitmu - embūbu - pītu*

...and that the pitches included in the sets above amount to a span of fifteen pitches. Therefore, no other sets are required.

Thus, text U.7/80 is a prescriptive manual which shows how a systemic enneatonic thetical system can host four dynamic sets spanning fifteen strings.

The sets would have been:

	Thetic	Dynamic
pītu	a-g-f-e-d-c-b-a-g	a-g-f-e-d-c-b-a-g
embūbu	a-g-f#-e-d-c-b-a-g	d-c-b-a-g-f-e-d-c
kitmu	a-g-f#-e-d-c#-b-a-g	g-f-e-d-c-b-a-g-f
išartu	a-g#-f#-e-d-c#-b-a-g#	c-b-a-g-f-e-d-c-b

Further questions arise from this text. There is no evidence that it extended to other quatrains as there is no evidence of Old-Babylonian terms, at least in a musical context, such as, *nīd qabli* and *nīš tuḫri* where *nīd qabli* would have meant 'fall of the middle' and *nīš tuḫri* 'rise of the *tuḫri*'(part of the foot?). Those terms might have existed as intervals but not specifically as pitch sets. However, it is very probable that the second part extended to *embūbu* and to *pītu* in respect of the symmetry of this text.

It is possible that the extension to sets of *nīd qabli*, *nīš tuḫri* and *qablītu* came as later additions which concluded with an initial *išartu,* but there is no evidence for it. The only reason for the extension to seven/eight quatrains was that certain researchers were absolutely assured that the system was heptatonic.

Thetical system

The thetical system must now be explained. In the case of the set of *pītu*, its thetical form would be a-g-f-e-d-c-b-a-g. Its dynamic would also be a-g-f-e-d-c-b-a-g. However, should the next set be thetic c-b-a-g-f#-e-d-c-b, the dynamic would be f-e-c-d-b-a-g-f-e. But when a-g-f-e-d-c-b-a-g is thetic *pītu*, the dynamic equivalent is a-g-f-e-d-c-b-a-g, and when thetic *pītu* turns into thetic *embūbu* = a-g-f#-e-d-c-b-a-g, dynamic *embūbu* becomes d-c-b-a-g-f-e-d-c. However, thetic *embūbu* could also be c#-b-a#-g#-f#-e#-d#-c#-b since it has the same intervallic positions.

Thetical tuning problematics

Had Old-Babylonian musicians followed the rules in my reconstruction of U.7/80, then it would have been reasonably simple for them to tune *embūbu* from *pītu* as only one string would have needed tensing. *kitmu* from *embūbu* would also have needed only one string tensed. However tuning from *pītu* to *išartu* would have needed four strings to be tensed, a lengthy task considering the instability of tuning.

Therefore it is reasonable to assume that the changing of sets would not have been practical in the context of a concert at the court or of a performance at the temple unless the pieces played were restricted to one set. Therefore, I believe that the dynamic setting of the strings would have been the favoured option, especially that melodies would not have exceeded a fifth. Now the limitation of the fifth in composition does not mean that it would have been 'primitive', a term which I profoundly dislike in musicology. There can be wonderful compositions from only five consecutive pitches.

It is highly probable, during the Neo-Babylonian period, as I mentioned earlier, that U.7/80 had been complemented with more sets: *nīd qabli*, *nīš tuḫri*, *qablītu* and *išartu*. It would have been possible to adapt U.7/80 to recently developed heptatonism with the procedure in Gurney's second article, Babylonian Music Again[20].

20. Gurney, O.R., Babylonian Music Again, *IRAQ* Vol. 56 (1994), pp.101-106.

However, there is no evidence for it although logic would be in favour of such an arrangement, but logic is not evidence and even less proof of evidence.

There is another powerful argument against the current belief that U.7/80 listed two part of seven or eight heptatonic quatrains each for the simple reason that one set of nine pitches can host three dynamic heptatonic sets.

Therefore, the enneatonic set of *pītu*, or a-g-f-e-d-c-b-a-g can host in the heptatonic a-g-f-e-d-c-b = *pītu*; g-f-e-d-c-b-a = *kitmu* and f-e-d-c-b-a-g = *qablītu*, etc. Therefore what would have been the point of having a set of seven 'modes' as described by Gurney and adopted by most?

Pitch set formation

In order to accommodate the seven descending conjoined fifths, the ambitus must have been hendecachordal, as I shall now explain.

Text U.7/80 has proven that the scales it displays are composed of two conjoined primary descending diatonic fifths. Therefore these sets were descending diatonic enneatonic. However, I remain cautious in avoiding generalisms, and therefore will not, on the basis of one tablet only, dictate that this applied for all sets of different systems and at all times.

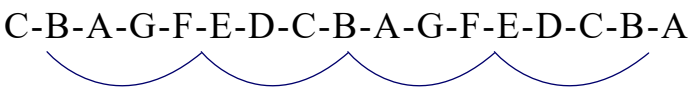
It is obvious that an enneatonic system can host heptatonism, but it is not because it can that it does.

We have to consider that the systems discussed here are hesitantly complex because they constitute the earliest attempts at designing a coherent and cogent music theory. The scribes who wrote these early texts might have been conversant with arithmetics but probably not with the physical qualities of sound and even less with the practice of music. Therefore we cannot assume that they were cognizant with a form of heptatonism that would have sprouted spontaneously from the earliest babblings of theory four thousand years ago. Heptatonism has been the consequence of a slow and lengthy systemic evolution which worked through numbers of designs derived from what Leon Crickmore

called 'harmonic mythology'[21], hence the application of symmetry in early systems that we find with the boviform lyres of the Sumerians.

For certain, secondary intervals of the third would have conjoined in intervals of fifths and intervals of fifths in enneatonic sets which would have taken the names of the intervals with which they started, initially, and then modified their position to suit texts such as U.7/80 as I shall explain below.

The conjoining of four primary intervals would have given the dynamic span of the system, a heptadecachord:



This might have been the forerunner of the cycle of fifths. However, the principle of the cyclicity of fifths was not known four thousand years ago, or at least we have no evidence for it, therefore they used a linear system dictated to them from the symmetric emplacement of strings and their tuning levers on the yoke of the lyre and later codified with Nabnitu xxxii.

Now the particularity of Babylonian dynamic descending hendecachordal ambiti sets is that the intervals of which they are composed change position according to the set to which they belong. For instance in a descending set starting with c: c-b-a-g-f-e-d-c-b-a-g, the interval *niš tuḫri* is placed on the first and the fifth pitches of the set: c-b-a-g-f. With a set starting with e: e-d-c-b-a-g-f-e-d-c-b, *niš tuḫri* will be e-d-c-b-a.

21. Crickmore, L., *Music Theory Spectrum*, Vol. 30, no. 2, Fall 2008, p. 331: '…there are hints in the evidence-bases of several disparate disciplines which suggest that each of the four ancient literate civilizations (South Asia, Middle East, East Asia and Europe) developed, and possibly shared systems of mathematical and music theory with extra-musical associations. If we seriously wish to pursue this developing area of research, we may need to coin some new term, such as 'Harmonic Mythology' to describe it.'

For example, with the hendecachordal descending set from C’:

Hendecachordal descending set from C’										
C’	B’	A’	G’	F’	E’	D’	C	B	A	G
nīš tuḫri										
	išartu									
		embūbu								
			nīd qabli							
				qablītu						
					kitmu					
						pītu				

For example, with the hendecachordal descending set from B’:

Hendecachordal descending set from B’:										
B’	A’	G’	F’	E’	D’	C’	B	A	G	F
nīš tuḫri										
	išartu									
		embūbu								
			nīd qabli							
				qablītu						
					kitmu					
						pītu				

Table 3. Examples of descending hendecachordal sets with the location of their constitutive intervals.

These two examples above can easily be complemented by the reader.

I shall now explain what would have been the initial structure of enneatonic sets. There I would like to remind the reader that theory includes ambitus and system. Babylonians would have had heptadecachordal and hendecachordal ambiti within which they applied Old-Babylonian enneatonic, and later Neo-Babylonian systems.

I contend that the original arrangement of enneatonic sets would have started with the interval which gave the name of the set:

išartu	=	*išartu*	+	*kitmu*	=	b-a-g-f-**e**-d-c-b-a
qablītu	=	*qablītu*	+	*išartu*	=	f-e-d-c-**b**-a-g-f-e
niš tuḫri	=	*niš tuḫri*	+	*qablītu*	=	c-b-a-g-**f**-e-d-c-b
nīd qabli	=	*nīd qabli*	+	*niš tuḫri*	=	g-f-e-d-**c**-b-a-g-f
pītu	=	*pītu*	+	*nīd qabli*	=	d-c-b-a-**g**-f-e-d-c
embūbu	=	*embūbu*	+	*pītu*	=	a-g-f-e-**d**-c-b-a-g
kitmu	=	*kitmu*	+	*embūbu*	=	e-d-c-b-**a**-g-f-e-d
išartu	=	*išartu*	+	*kitmu*	=	b-a-g-f-**e**-d-c-b-a

Table 4. Sets where the name and position of the first primary interval gives its name to the set. Note the alternation of the first to second intervals indicated with red arrows.

išartu	=	*niš tuḫri*	+	*qablītu*	=	c-b-a-g-**f**-e-d-c-b
qablītu	=	*qablītu*	+	*išartu*	=	f-e-d-c-**b**-a-g-f-e
niš tuḫri	=	*išartu*	+	*kitmu*	=	b-a-g-f-**e**-d-c-b-a
nīd qabli	=	*kitmu*	+	*embūbu*	=	e-d-c-b-**a**-g-f-e-d
pītu	=	*embūbu*	+	*pītu*	=	a-g-f-e-**d**-c-b-a-g
embūbu	=	*pītu*	+	*nīd qabli*	=	d-c-b-a-**g**-f-e-d-c
kitmu	=	*nīd qabli*	+	*niš tuḫri*	=	g-f-e-d-**c**-b-a-g-f
išartu	=	*niš tuḫri*	+	*qablītu*	=	c-b-a-g-**f**-e-d-c-b

Table 5. Sets where the name and position of the primary interval no longer defines the name of the set to which they belong and are placed in order to fit the instructions in U.7/80.

In the above disposition in table 4, the instructions which are applicable to the sets in table 5 need to be changed as these sets are no longer in the order in which they are defined with U.7/80. Table 6 next page gives the variations and execution of the instructions suited to the sets in table 4.

It goes without saying that the disposition of the intervals in table 4 would have been antecedent to the disposition if table 5. This would have been a consequence of the change of a systemic of of an additional contribution of the dynamic to the thetical.

Set		Thetic	Dynamic
išartu	=	B-A-G-F-E-D-C-B-A =	B-A-G-F-E-D-C-B-A
la zaku $4^f/2^b$	=	B-A-G-**A**-E-D-C-**B**-A =	B-A-G-F-E-D-C-B-A
Tense 4^f	=	B-A-G-**F#**-E-D-C-B-A =	E-D-C-B-A-G-F-E-D
qablītu	=	B-A-G-F#-E-D-C-B-A =	E-D-C-B-A-G-F-E-D
la zaku $4^f/3^b$	=	B-A-G-**F#**-E-D-**C**-B-A =	E-D-C-B-A-G-F-E-D
Tense 3^b	=	B-A-G-**F#**-E-D-**C#**-B-A =	A-G-F-E-D-C-B-A-G
nīs tuḫri	=	B-A-G-F#-E-D-C#-B-A =	A-G-F-E-D-C-B-A-G
la zaku $3^f/3^b$	=	B-A-**G**-F#-E-D-**C#**-B-A =	A-G-F-E-D-C-B-A-G
Tense 3^f	=	B-A-**G#**-F#-E-D-C#-B-A =	D-C-B-A-B-F-E-D-C
nīd qabli	=	B-A-G#-F#-E-D-C#-B-A =	D-C-B-A-B-F-E-D-C
la zaku $3^f/4^b$	=	B-A-**G#**-F#-E-**D**-C#-B-A =	D-C-B-A-B-F-E-D-C
Tense 4^b	=	B-A-G#-F#-E-**D#**-C#-B-A =	G-F-E-D-C-B-A-G-F
pītu	=	B-A-G#-F#-E-D#-C#-B-A =	G-F-E-D-C-B-A-G-F
la zaku $2^f/4^b$	=	B-**A**-G#-F#-E-**D#**-C#-B-A =	G-F-E-D-C-B-A-G-F
Tense $2^f/1^b$	=	B-**A#**-G#-F#-E-D#-C#-B-**A#** =	C-B-A-G-F-E-D-C-B
embūbu	=	B-A#-G#-F#-E-D#-C#-B-A# =	C-B-A-G-F-E-D-C-B
la zaku $5/1^b$	=	B-A#-G#-F#-**E**-D#-C#-B-**A#** =	C-B-A-G-F-E-D-C-B
Tense 5	=	B-A#-G#-F#-**E#**-D#-C#-B-A# =	F-E-D-C-B-A-G-F-E
kitmu	=	B-A#-G#-F#-E#-D#-C#-B-A# =	F-E-D-C-B-A-G-F-E
la zaku $1^f/5$	=	**B**-A#-G#-F#-**E#**-D#-C#-B-A# =	F-E-D-C-B-A-G-F-E
Tense $1^f/2^b$	=	**B#**-A#-G#-F#-**E#**-D#-C#-**B#**-A# =	B-A-G-F-E-D-C-B-A
išartu	=	B#-A#-G#-F#-E#-D#-C#-B#-A# =	B-A-G-F-E-D-C-B-A

Table 6. Variation of the instructions in U.7/80 for the system in table 4.

What is the meaning of table 6?

The variation from U.7/80 described in table 6 above is highly significant. The sets remain indubitably diatonic descending enneatonic having for consequence the inversion of certain fifths into fourths. However, this disposition of the intervals with primary intervals starting the set of the same name would be in favour for this variation being antecedent to the original U.7/80. However, the question remains as to which quatrain started the metabolic sequence. I am in favour of the descending enneatonic set of A-G-F-E-D-C-B-A-G since I contend this was the construction described in enneatonic Nabnitu xxxii.

CBS 10996 again

It is now appropriate to introduce text CBS 10996 which has been succinctly discussed earlier. It dates from the middle of the first millennium BC and holds and locates a series of numbers grouped in pairs to which names are given. The series of numbers is (1-5) (7-5) (2-6) (1-6) (3-7) (2-7) (1-4) (1-3) (5-2) (2-4) (6-3) (3-5) (7-4) (4-6). It goes without saying that these numbers address to a heptatonic arrangement.The irregularity of the sequence evokes a restitution of what would have been the original sequence of paired numbers: (1-5) (7-5) (2-6) (8-6) (3-7) (9-7) (4-8) (10-8) (5-9) (11-9) (6-10) (12-10) (7-11) (13-11). This restored series reveals two types of intervals: Primary intervals which are descending, or falling fifths; Secondary intervals[22] which are ascending, or rising thirds. May I remind the reader that the falling of the system was once for all resolved by Gurney[23]. However, that the system is falling in U.7/80 is not evidence that the primary intervals in CBS 10996 were descending while the secondary were ascending. However, since the pitch-sets arising from U/7/80 take their

22. Kilmer, A.D., The Cult Song with Music from Ancient Ugarit: Another Interpretation. *Revue d'Assyriologie et d'archéologie orientale*, Vol. 68, No. 1 (1974), citing Wulstan p. 76, fig. 6. Most interestingly, Wulstan thought that primary intervals could be either rising or falling and that thirds were also either rising of falling..

23, Babylonian Music Again, *IRAQ*, Vol. 56 (1994), p. 101.

name from primary intervals, then it is reasonable to assume, to the risk of being proven wrong in the future, that primary intervals were falling. Since sets are built from the conjoining of two descending primary intervals, it goes without saying that Kilmer's premise that these intervals were harmonic dichords, is flawed, as is her interpretation of Hurrian text H6.

The function of thirds in CBS 10996

Until now there has been the most fanciful interpretations for the purpose of the thirds in *CBS* 10996. Some have even argued that they served for the refinement of the tuning of fifths, but this is probably because these authors have no idea that it is the number of the beats between both pitches of a third when played simultaneously and their counting, then the increasing or decreasing of the number of beats per second by tensioning or relaxing one of the pitches which are the means by which any tuning can be refined, and specifically when one knows by which quantity each third should beat in order to even up a temperament. The refining of the tuning by thirds is not a matter of pitch but it is a matter of one's ability to count beats per second. This is a complex process and the hypothesis that Babylonian theoreticians knew about this phenomenon for that purpose is simply so absurd that I do not need to justify myself with any further explanations.

The reason for the position and polarity of the intervals of thirds as they are placed between intervals of fifths in my reconstruction of *CBS* 10996 has never been elucidated by any scholar having written about this text.

A pattern arises from their position: Interval of third *šeru* (7-5) at line 2 (of the first part) plus interval of third *rebūtu* (9-7) at line 6 equals interval of fifth (5-9) *qablītu* at line 9. This can be simplified as (l.2)7-5 + (l.4)9-7 = (l.9)5-9. The series continues with 8-6 + 10-8 = 6-10; 9-7 + 11-9 = 7-11, etc. In this clever arrangement we understand why the thirds are ascending as they have the highest integer on the outside (7-5/9-7) while the inner integers give the fifth they produce

(7-5/9-7). This will conclusively prove that fifths are constructed from specific conjoined thirds, and that their position in the system has a purpose of order, linearly: (l.2; l.6; l.9) (l.4; l.8; l.11) (l.6; l.10; l. 13) (l.8; l.12; l.15) (l.10; l.14; l.17) (l.12; l.16; l.19) (l.14; l.18; l.21) etc.

This is best illustrated with the following graphic:

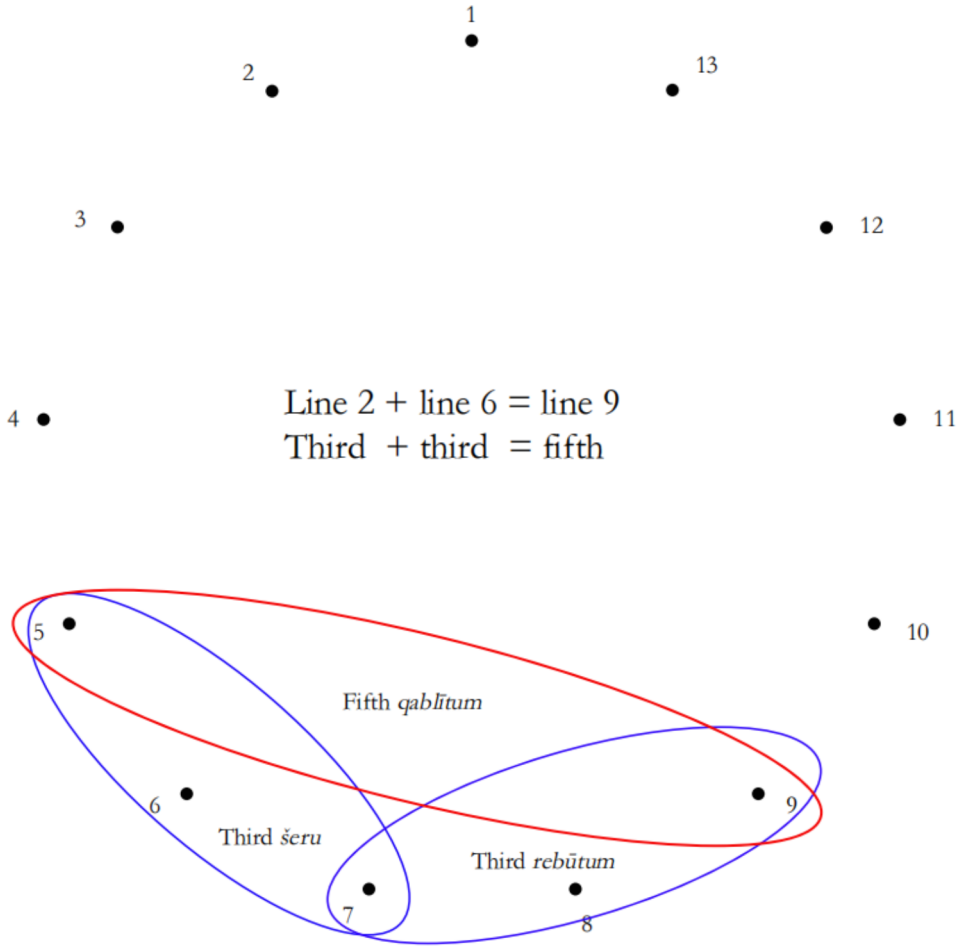


Figure 4. Position of the thirds in lines 2 and six amounting to the fifth in line 9.

Elusive octave

About finding an octave in U.7/80 and elsewhere in Babylonian theory, I will say that the tuning of two pitches which some consider to be a systemic octave are to be considered as belonging to two distinct systemic fifths where the span of the octave is inexistent, and although they sound the octave this interval is not conceptually octaval. The octave is such an important concept that it would not have eluded Babylonian scholarship and if it were not written down on the few texts we have it is because it did not exist. If it did, they would have written it down unequivocally.

Conclusions

While it has been adequately proven that the mid first millennium BC saw the advent of a diatonic heptatonic system from evidence in texts *CBS* 1766 and *CBS* 10996, I hope that I have conclusively demonstrated that Old-Babylonian theory was dominated by enneatonic systemics. However, the longevity of Nabnitu would be in favour of considering that diatonic enneatonism lived alongside diatonic heptatonism and probably with an elusive anhemitonism, each system serving different purposes and probably different instruments in a manner similar to contemporary classical music of the twenty-first millennium living alongside a ‘pop music’ which remains resolutely stuck with eighteen century baroque music theory.